

Description of Research Project – Form 442 – Question 6
File No. 0228-EX-PL-2004

The PICOSAT project at The Aerospace Corporation intends to deploy a small satellite into low earth orbit using either the Space Shuttle Transportation System or another launch vehicle. The small satellite uses a modified 914.7 MHz commercial radio (Freewave Technologies, Inc, Boulder Colorado) as its communications system. The radios will be directed to operate in single frequency mode, i.e. hopping to the same channel every time. This is necessary to minimize re-acquisition time when the satellite rotates through an antenna pattern null and loses lock. The radio on the satellite outputs 2 watts maximum, which then feeds into a patch antenna that has been tuned to produce a spherical, even energy pattern—resulting in an EIRP < 23dBm. The orbit is anywhere from 200 miles altitude to 450 miles, so the RF energy at the earth down linked from the satellite is very small since the minimal space loss attenuation is -144 dB.

The ground station is the other end of the communications link. A typical satellite pass over a ground station lasts only 5 minutes and occurs typically two times per day. Several ground stations are envisioned as part of this test. The first is a 42 dB gain reflector located in Menlo Park, California. The radio at this location will output 1 W at 914.7 MHz into this antenna on the uplink. The second ground station is an 18 dB gain reflector located in Joshua Tree National Monument, California. The radio at this location will output 10W into this antenna on the uplink. Joshua Tree was chosen to minimize the 914.7 MHz energy input to the antenna from other sources. The third ground station is a 32 dB gain reflector at the US Naval Academy in Annapolis, MD. The radio at this location will output 2 W at 914.7 MHz into this antenna on the uplink. The two urban ground stations at Menlo Park, CA and Annapolis, MD have highly directional antennas, which will be pointed above the horizon, allowing only side-lobes of ~ -40dB to affect the local area.

The test duration will be less than 2 weeks because the satellites are battery powered without the ability to recharge.